CLAIMS

1. A recycling method comprising:

selectively combusting a carbon component in a material;

pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source; and

supplying a pyrolysate produced in said pyrolyzing and gasifying process to at least one of an oil refinery process and a petrochemical process.

2. A recycling method comprising:

selectively combusting a carbon component in a material;

pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;

cooling and cleaning a pyrolysate produced in said pyrolyzing and gasifying process; and

supplying the cooled and cleaned pyrolysate to at least one of an oil refinery process and a petrochemical process.

3. The recycling method as recited in claim 1 or 2, wherein said supplying process comprises supplying the pyrolysate to an atmospheric distillation process of the oil refinery process.

4. The recycling method as recited in claim 1 or 2, wherein said supplying process comprises supplying the pyrolysate to an ethylene production process of the petrochemical process.

5. A recycling method comprising:

selectively combusting a carbon component in a material;

pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;

separating a pyrolysate produced in said pyrolyzing and gasifying process into fractions; and

supplying the fractions to at least one of an oil refinery process and a petrochemical process.

6. A recycling method comprising:

selectively combusting a carbon component in a material;

pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;

cooling and cleaning a pyrolysate produced in said pyrolyzing and gasifying process;

separating the cooled and cleaned pyrolysate into fractions; and

supplying the fractions to at least one of an oil refinery process and a petrochemical process.

7. The recycling method as recited in claim 5 or 6, wherein the fractions comprise at least one of gas, naphtha, kerosene, and light oil.

8. The recycling method as recited in any one of claims 5 through 7, wherein said supplying process comprises supplying the fractions to an atmospheric distillation process of the oil refinery process.

9. The recycling method as recited in any one of claims 5 through 7, wherein said supplying process comprises supplying the fractions to an ethylene production process of the petrochemical process.

10. A recycling method comprising:

selectively combusting a carbon component in a material;

pyrolyzing and gasifying the material by using heat of combustion in said combusting process as a heat source;

cleaning a pyrolysate produced in said pyrolyzing and gasifying process with distillate oil discharged from an atmospheric distillation process of an oil refinery process or oil into which the distillate oil has been refined; and

supplying at least one of the oil used in said cleaning process and the cleaned pyrolysate to at least one of the atmospheric distillation process of the oil refinery process and a petrochemical process.

11. The recycling method as recited in any one of claims 1 through 10, wherein the material includes residual oil discharged from the oil refinery process or the petrochemical process.

12. The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil discharged from an atmospheric distillation process of the oil refinery process.

13. The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation process of the oil refinery process and flashed under a reduced pressure.

14. The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation process or a vacuum distillation process of the oil refinery process and pyrolyzed.

15. The recycling method as recited in claim 11, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an ethylene production process of the petrochemical process.

16. The recycling method as recited in claim 15, wherein the residual oil comprises pyrolyzed tar.

17. The recycling method as recited in any one of claims 1 through 10, wherein the material includes waste.

18. The recycling method as recited in claim 17, wherein the waste comprises at least one of waste plastic and shredder dust.

19. The recycling method as recited in any one of claims 1 through 10, wherein the material includes organic matter.

20. The recycling method as recited in claim 19, wherein the organic matter comprises biomass.

21. The recycling method as recited in any one of claims 1 through 20, further comprising using at least one of hydrogen gas, methane gas, ethylene gas, ethane gas, propylene gas, propane gas, and steam as a gasifying agent for said pyrolyzing and gasifying process.

22. The recycling method as recited in any one of claims 1 through 20, further comprising using gas recovered in the oil refinery process as a gasifying agent for said pyrolyzing and gasifying process.

23. The recycling method as recited in any one of claims 1 through 20, further comprising using particles containing metal as a heating medium for said pyrolyzing and gasifying process.

24. The recycling method as recited in claim 23, wherein the metal comprises iron, cobalt, or ruthenium.

25. The recycling method as recited in any one of claims 1 through 20, further comprising using a substance having a desulfurization function as a heating medium for said pyrolyzing and gasifying process.

26. The recycling method as recited in claim 25, wherein the substance comprises calcium oxide, calcium carbonate, or calcium hydroxide.

27. The recycling method as recited in any one of claims 1 through 26, wherein said pyrolyzing and gasifying process is performed by a pyrolysis apparatus having a combustion chamber for selectively combusting the carbon component and a gasification chamber for pyrolyzing and gasifying the material by using heat of combustion in the combustion chamber as a heat source.

28. The recycling method as recited in claim 27, wherein the pyrolysis apparatus comprises an internal circulating fluidized-bed gasification furnace.

29. The recycling method as recited in claim 27 or 28, further comprising supplying the material to both of the combustion chamber and the gasifying chamber of the pyrolysis apparatus.

30. A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source; and

a passage for supplying a pyrolysate produced in said gasification section to at least one of an oil refinery system and a petrochemical system.

31. A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

an oil scrubber disposed downstream of said gasification section for cooling and cleaning a pyrolysate produced in said gasification section; and

a passage for supplying the cooled and cleaned pyrolysate to at least one of an oil refinery system and a petrochemical system.

32. The recycling system as recited in claim 30 or 31, wherein said passage is configured to supply the pyrolysate to an atmospheric distillation unit of the oil refinery system.

33. The recycling system as recited in claim 30 or 31, wherein said passage is configured to supply the pyrolysate to an ethylene production system of the petrochemical system.

34. A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

a fractionating tower disposed downstream of said gasification section for separating a pyrolysate produced in said gasification section into fractions; and

a passage for supplying the fractions to at least one of an oil refinery system and a petrochemical system.

35. A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

an oil scrubber disposed downstream of said gasification section for cooling and cleaning a pyrolysate produced in said gasification section;

a fractionating tower disposed downstream of said gasification section for separating the cooled and cleaned pyrolysate into fractions; and

a passage for supplying the fractions to at least one of an oil refinery system and a petrochemical system.

36. The recycling system as recited in claim 34 or 35, wherein the fractions comprise at least one of gas, naphtha, kerosene, and light oil.

37. The recycling system as recited in any one of claims 34 through 36, wherein said passage is configured to supply the fractions to an atmospheric distillation unit of the oil refinery system.

38. The recycling system as recited in any one of claims 34 through 36, wherein said passage is configured to supply the fractions to an ethylene production system of the petrochemical system.

39. A recycling system comprising:

a pyrolysis apparatus having a combustion section for selectively combusting a carbon component in a material, and a gasification section for pyrolyzing and gasifying the material by using heat of combustion in said combustion section as a heat source;

a cleaning unit for cleaning a pyrolysate produced in said gasification section with distillate oil discharged from an atmospheric distillation unit of an oil refinery system or oil into which the distillate oil has been refined; and

a passage for supplying at least one of the oil used in said cleaning unit and the cleaned pyrolysate to at least one of the atmospheric distillation unit of the oil refinery system and a petrochemical system.

40. The recycling system as recited in any one of claims 30 through 39, wherein the material includes residual oil discharged from the oil refinery system or the petrochemical system.

41. The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil discharged from an atmospheric distillation unit of the oil refinery system.

42. The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation unit of the oil refinery system and flashed under a reduced pressure.

43. The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an atmospheric distillation unit or a vacuum distillation unit of the oil refinery system and pyrolyzed.

44. The recycling system as recited in claim 40, wherein the residual oil comprises residual hydrocarbon heavy oil that has been discharged from an ethylene production system of the petrochemical system.

45. The recycling system as recited in claim 44, wherein the residual oil comprises pyrolyzed tar.

46. The recycling system as recited in any one of claims 30 through 39, wherein the material includes waste.

47. The recycling system as recited in claim 46, wherein the waste comprises at least one of waste plastic and shredder dust.

48. The recycling system as recited in any one of claims 30 through 39, wherein the material includes organic matter.

49. The recycling system as recited in claim 48, wherein the organic matter comprises biomass.

50. The recycling system as recited in any one of claims 30 through 49, wherein at least one of hydrogen gas, methane gas, ethylene gas, ethane gas, propylene gas, propane gas, and steam is used as a gasifying agent in said gasification section.

51. The recycling system as recited in any one of claims 30 through 49, wherein gas recovered in the oil refinery system is used as a gasifying agent in said gasification section.

52. The recycling system as recited in any one of claims 30 through 49, wherein particles containing metal are used as a heating medium in said gasification section.

53. The recycling system as recited in claim 52, wherein the metal comprises iron, cobalt, or ruthenium.

54. The recycling system as recited in any one of claims 30 through 49, wherein a substance having a desulfurization function is used as a heating medium in said gasification section.

55. The recycling system as recited in claim 54, wherein the substance comprises calcium oxide, calcium carbonate, or calcium hydroxide.

56. The recycling system as recited in any one of claims 30 through 55, wherein said pyrolysis apparatus comprises a combustion chamber for selectively combusting the carbon component and a gasification chamber for pyrolyzing and gasifying the material by using heat of combustion in said combustion chamber as a heat source.

57. The recycling system as recited in claim 56, wherein said pyrolysis apparatus comprises an internal circulating fluidized-bed gasification furnace.

58. The recycling system as recited in any one of claims 30 through 57, further comprising a passage for supplying the material to both of said combustion section and said gasifying section of said pyrolysis apparatus.